

PATENT COOPERATION TREATY

PCT

NOTIFICATION OF THE RECORDING
OF A CHANGE(PCT Rule 92bis.1 and
Administrative Instructions, Section 422)Date of mailing (day/month/year)
21 August 2001 (21.08.01)

From the INTERNATIONAL BUREAU

To:

SCHÄFERJOHANN, Volker
Deutsche Thomson-Brandt GmbH
European Patent Operations
Karl-Wiechert-Allee 74
D-30625 Hannover
ALLEMAGNEApplicant's or agent's file reference
PD990054

IMPORTANT NOTIFICATION

International application No.
PCT/EP00/06476International filing date (day/month/year)
07 July 2000 (07.07.00)

1. The following indications appeared on record concerning:

 the applicant the inventor the agent the common representativeName and Address
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2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

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3. Further observations, if necessary:

4. A copy of this notification has been sent to:

 the receiving Office the designated Offices concerned
 the International Searching Authority the elected Offices concerned
 the International Preliminary Examining Authority other:The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland
Facsimile No.: (41-22) 740.14.35

Authorized officer

QIU Anman
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PATENT COOPERATION TREATY

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NOTIFICATION OF ELECTION
(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Commissioner
US Department of Commerce
United States Patent and Trademark
Office, PCT
2011 South Clark Place Room
CP2/5C24
Arlington, VA 22202
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

| | |
|---|---|
| Date of mailing (day/month/year) 07 March 2001 (07.03.01) | To: |
| International application No. PCT/EP00/06476 | Applicant's or agent's file reference PD990054 |
| International filing date (day/month/year) 07 July 2000 (07.07.00) | Priority date (day/month/year) 19 July 1999 (19.07.99) |
| Applicant GAEDKE, Klaus et al | |

1. The designated Office is hereby notified of its election made:

in the demand filed with the International Preliminary Examining Authority on:
20 January 2001 (20.01.01)

in a notice effecting later election filed with the International Bureau on:

2. The election was
 was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

| | |
|---|--|
| The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35 | Authorized officer Zakaria EL KHODARY Telephone No.: (41-22) 338.83.38 |
|---|--|

REMINDE

23.11.01 P0

PCT

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

SCHÄFERJOHANN, V.
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ALLEMAGNE

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| THOMSON multimedia | |
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| 23. Nov. 2001 | |
| Patent Department Administration-Hannover | |

FAX: 511/418-2811

NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL PRELIMINARY
EXAMINATION REPORT

(PCT Rule 71.1)

Date of mailing
(day/month/year) 08.10.2001Applicant's or agent's file reference
PD990054

IMPORTANT NOTIFICATION

International application No.
PCT/EP00/06476International filing date (day/month/year)
07/07/2000Priority date (day/month/year)
19/07/1999Applicant
DEUTSCHE THOMSON-BRANDT GMBH

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. REMINDER

The applicant must enter the national phase before each elected Office by performing certain acts (filling translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

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PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

| | | | |
|---|--|--|---|
| Applicant's or agent's file reference PD990054 | FOR FURTHER ACTION | | See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416) |
| International application No. PCT/EP00/06476 | International filing date (day/month/year) 07/07/2000 | Priority date (day/month/year) 19/07/1999 | |
| International Patent Classification (IPC) or national classification and IPC H04B10/00 | | | |
| <p>Applicant DEUTSCHE THOMSON-BRANDT GMBH</p> <p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 5 sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of 2 sheets.</p> <p>3. This report contains indications relating to the following items:</p> <ul style="list-style-type: none"> I <input checked="" type="checkbox"/> Basis of the report II <input type="checkbox"/> Priority III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability IV <input type="checkbox"/> Lack of unity of invention V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement VI <input type="checkbox"/> Certain documents cited VII <input type="checkbox"/> Certain defects in the International application VIII <input type="checkbox"/> Certain observations on the international application | | | |

| | |
|--|---|
| Data of submission of the demand 20/01/2001 | Date of completion of this report 08.10.2001 |
| Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465 | Authorized officer Phillips, S Telephone No. +49 89 2399 8674 |



**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/EP00/06476

I. Basis of the report

1. With regard to the elements of the international application (Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)):

Description, pages:

1-10 as originally filed

Claims, No.:

1-5 with telefax of 11/07/2001

Drawings, sheets:

1/3-3/3 as originally filed

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- the language of publication of the international application (under Rule 48.3(b)).
- the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- contained in the international application in written form.
- filed together with the international application in computer readable form.
- furnished subsequently to this Authority in written form.
- furnished subsequently to this Authority in computer readable form.
- The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- the description, pages:
- the claims, Nos.:

INTERNATIONAL PRELIMINARY
EXAMINATION REPORT

International application No. PCT/EP00/06476

 the drawings, sheets:

5. This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).
(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)
see separate sheet

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability;
citations and explanations supporting such statement

1. Statement

Novelty (N) Yes: Claims 1-5
No: Claims

Inventive step (IS) Yes: Claims 1-5
No: Claims

Industrial applicability (IA) Yes: Claims 1-5
No: Claims

2. Citations and explanations
see separate sheet

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/EP00/06476

Section I

1. **Claim 1** is based on original claims 1 and 2 plus the description page 6 lines 9-12.
2. The wording "in a manner dependent on control signals output by one of the two circuit units" which was present in claims 1 and 2 has not been included in the present **claim 1**. This is considered as a broadening of the subject matter over that contained in the application as originally filed since the switching signals are now no longer limited to being generated in dependence on control signals output by one of the two circuit units (Rule 70.2(c) PCT).

Section V

1. The application relates to an electrical insulation device for a bidirectional connecting line (**claim 1**).
2. The prior art relevant to the subject matter of **claim 1** is outlined in the description from page 1 line 9 to page 3 line 5. Neither this prior art, nor the documents cited in the International search report, disclose the use of optocouplers controlled by switching signals provided by a control unit dependent on control signals output by one of two circuit units, for switching the direction of signals along a bidirectional line connecting the two circuit units. The subject-matter of **claim 1** is therefore novel (Article 33(2) PCT).
3. Problem: How to control bidirectional signal flow between a data link layer module and a physical layer module (circuit units) of a bus interface which are integrated on a single chip.
4. Solution: The feature which is new with respect to the available prior art is to provide either a single optocoupler or two separate optocouplers controlled by switching signals provided by a control unit dependent on control signals output by one of two circuit units, for switching the direction of signals along a bidirectional line connecting the two circuit units. None of the available prior art documents provide any hint to do this and hence the particular solution is non-obvious and considered to be inventive (Article 33(3) PCT).

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/EP00/06476

5. The dependent claims add further features to the independent claims and thus also relate to novel and inventive subject matter and hence meet the requirements of Article 33(2) and (3) PCT.

New Claims

1. Electrical insulation device for a bidirectional connecting line (CTL[0:1], D[0:7]), that connects two electronic circuit units (10, 20) to one another, said electrical insulation unit (30) being located anywhere along the connecting line (CTL[0:1], D[0:7]) and comprises at least one optocoupler providing electrical insulation, characterized in that, either one single optocoupler or two separate optocouplers (311, 312) are provided for the bidirectional connecting line (CTL[0:1], D[0:7]), and in that a control unit (33) is provided, which generates switching signals (EN, \overline{EN}), which switching signals (EN, \overline{EN}) either change over the effective direction of the single optocoupler with regard to the associated connecting line (CTL[0:1], D[0:7]), or which switching signals activate one of the two optocouplers (311, 312) and deactivate the other optocoupler, for transmission of signals via the associated connecting line (CTL[0:1], D[0:7]) in a direction opposite to the previous signal flow direction.

2. Electrical insulation device according to Claim 1, the bidirectional connecting line (CTL[0:1], D[0:7]) relating either to a data line (D[0:7]) or a control line (CTL[0:1]).

3. Electrical insulation device according to claim 1 or 2, the circuit units (10, 20) which are connected to one another via the connecting line relating to the circuit blocks, data link layer block (10) and physical layer block (20) of a connection interface, in particular IEEE 1394 bus interface.

35 4. Electrical insulation device according to Claim 3, the respective control unit (33) evaluating the control signals on two control lines (CTL[0:1]) of the connecting bus between data link layer block (10) and

physical layer block (20) in accordance with the IEEE 1394 Standard.

5. Electrical insulation device according to one of
5 Claims 1 to 4, tristate drivers (32), which are switched
into corresponding states by the control unit (33), being
used for changing over between the optocouplers or for
changing over the effective direction of one optocoupler.

(19) World Intellectual Property Organization
International Bureau(43) International Publication Date
25 January 2001 (25.01.2001)

PCT

(10) International Publication Number
WO 01/06680 A1

(51) International Patent Classification⁷: H04B 10/00 (74) Agent: SCHÄFERJOHANN, Volker; Deutsche Thomson-Brandt GmbH, European Patent Operations, Karl-Wiechert-Allee 74, D-30625 Hannover (DE).

(21) International Application Number: PCT/EP00/06476 (81) Designated States (national): AE, AG, AL, AU, BA, BB, BG, BR, CA, CN, CR, CU, CZ, DM, DZ, EE, GD, GE, HR, HU, ID, IL, IN, IS, JP, KP, KR, LC, LK, LR, LV, MA, MG, MK, MN, MX, NO, NZ, PL, RO, SG, SI, SK, TR, TT, UA, US, UZ, VN, YU, ZA.

(22) International Filing Date: 7 July 2000 (07.07.2000) (81) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

(25) Filing Language: English (26) Publication Language: English

(30) Priority Data: 19933135.9 19 July 1999 (19.07.1999) DE

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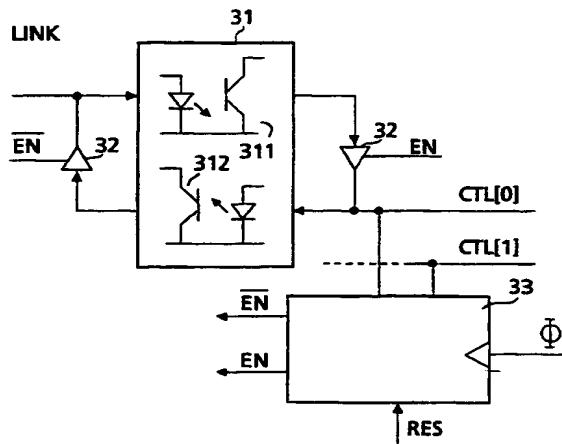
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Published:

— With international search report.

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: ELECTRICAL INSULATION DEVICE WITH OPTOCOUPLER FOR BIDIRECTIONAL CONNECTING LINES



WO 01/06680 A1

(57) Abstract: An electrical insulation device for bidirectional connecting lines (CTL[0:1], D[0:7]) is proposed which operates reliably at high frequencies and can be integrated easily on a chip. In accordance with a first embodiment, for the purpose of electrical isolation, two separate optocouplers (311, 312) are provided per bidirectional connecting line. A control unit (33) evaluates the control signals which are output by one of the two circuit units (10, 20), and thereupon activates one of the two optocouplers while the other optocoupler is simultaneously deactivated, in order, in this way, to allow transmission of signals via the associated connecting line in one direction. In a second embodiment of the invention, only a single optocoupler is provided per bidirectional connecting line. The control unit (33) is provided in this solution as well, except that in this case it changes over the effective direction of the optocoupler by means of corresponding circuit components (32), thereby once again achieving transmission of signals via the associated connecting line in one direction.

Electrical insulation device with optocoupler for bidirectional connecting lines

The invention relates to an electrical insulation device for bidirectional connecting lines/bus lines with the use of optocouplers.

Prior Art

The invention is based on an electrical insulation device for bidirectional connecting lines of the generic type of the independent Claims 1 and 2. If a plurality of independent apparatuses are interconnected via lines, then it is often necessary to provide electrical insulation between the interconnected components. This applies particularly whenever the connected apparatuses are installed e.g. in a manner distributed in a building. This is because in this situation relatively large potential differences between the apparatuses can occur, which are caused e.g. by different potentials on the power supply lines. Such potential differences may occur in the range from a few millivolts up to a number of volts. Potential differences of this type may be present with greater or lesser stability. They may vary e.g. in accordance with the instantaneous total power consumption in the building. However, they may also fail momentarily, with destructive effect, e.g. due to a lightning strike in the building itself or in the vicinity of the building.

In the less severe case, the data signals and/or control signals which run via the bus connections are merely corrupted. However, they can lead to the destruction of the connected circuit sections.

The problem of undesirable earth loops, caused by the connecting lines, frequently arises. By way of example, induced current can flow through the cable screen of the bus connection and likewise corrupt the transmitted data signals. If the induced potential difference is large enough, persons who happen to be

handling the corresponding bus connection cable could also be injured.

Therefore, the requirement for complete electrical isolation of the stations which are connected 5 to one another by lines is necessary.

One example of a bus system in which electrical isolation of the components which are connected to one another is required is the IEEE 1394 bus standard, which has recently acquired increasing importance. The exact 10 designation of this bus standard reads as follows: IEEE Std 1394-1995, "IEEE Standard for a high performance serial bus" of 12.12.1995.

What is involved is a bus system containing two data line pairs and also two power supply lines earth and 15 V_{cc} and also a cable screen in the bus connection cable. The two data line pairs allow synchronous serial data transmission. What is probably one of the most outstanding properties of the bus system is that data transmission is possible at very high data rates of 100 20 megabits per second up to 400 megabits per second.

With regard to the realization of electrical isolation of stations which are connected to one another via the bus, two explicit circuit realizations are specified in Appendix J.6 of the abovementioned standard. 25 In both cases, electrical isolation is performed between the data link layer module and the physical layer module. A transformer connected up appropriately with resistors and capacitors is used for the electrical isolation in one case, and capacitive decoupling is provided for the 30 electrical isolation in the other case. These solutions have assumed, however, that the data link layer module and the physical layer module are present as separate chips. It has been shown in retrospect that the capacitive isolation of the two modules does not 35 constitute a reliable solution in practice at the high frequencies. Instances of signal corruption and interfering irradiation have occurred. In the case of electrical insulation using a transformer, moreover,

there is the disadvantage that this solution can no longer be used if the data link layer module and the physical layer module of the bus interface are intended to be integrated on a single chip.

5 Furthermore, it is known to use so-called optocouplers for the electrical isolation of circuit units which are connected to one another.

Invention

10 The object of the invention is to specify an electrical insulation device in particular for bidirectional connecting lines which operates reliably even at very high frequencies and can be integrated very easily on a chip.

15 The object is achieved by means of the features of the independent Claims 1 and 2. In accordance with a first embodiment of the invention, the electrical insulation device for bidirectional connecting lines comprises two separate optocouplers per bidirectional connecting line and a control unit, which generates switching signals in a manner dependent on control signals output by one of the two circuit units, which switching signals, via corresponding switches, activate one of the two optocouplers and deactivate the other 20 optocoupler, and thus allow transmission of signals via the connecting line in one direction. This solution does not require poorly integrable components such as 25 transformers. Moreover, the aforementioned control unit can be constructed in a simple manner and can be readily 30 integrated on a chip.

The second solution according to the invention in accordance with Claim 2 manages with just one optocoupler per bidirectional connecting line. This is achieved by modifying the control unit in such a way that, in a 35 manner dependent on the control signals output by one of the two circuit units which are connected to one another, the said control unit changes over the effective direction of the optocoupler with regard to the

associated connecting line. In this case, it is necessary merely to provide two more switches for the switching operations. The implementation of such switches does not constitute a problem for the chip design. Therefore, this 5 solution provides an electrical insulation device which can be integrated in a particularly simple manner.

Further advantageous developments and improvements of the devices mentioned in Claims 1 and 2 are possible by virtue of the measures evinced in the 10 dependent claims. In accordance with Claim 4, the electrical insulation device may very advantageously be provided between a data link layer module and a physical layer module of a bus interface. If the solution is used in the case of an IEEE 1394 bus interface, then it 15 suffices for the respective control unit to evaluate the control signals on the two control lines CTL [0:1] of the connecting bus between the two modules in order to activate the corresponding optocoupler or to change over the effective direction of the optocoupler.

20 Tristate drivers, in particular, may expediently be used as switches for the changeover between the optocouplers or for changing over the effective direction of the optocoupler, the said tristate drivers being driven correspondingly by the control unit.

Drawings

The exemplary embodiments of the invention are illustrated in the drawings and are explained in more detail in the description below. In the figures:

5

Figure 1 shows the connecting lines between the data link module and the physical layer module in accordance with the IEEE 1394 standard;

10 Figure 2 shows the basic arrangement of the data link layer module, the electrical insulation device and the physical layer module;

Figure 3 shows the structure of the electrical insulation device in accordance with a first exemplary embodiment of the invention;

15 Figure 4 shows a state diagram of the control unit of the electrical insulation device as shown in Figure 3;

Figure 5 shows the structure of the electrical insulation device in accordance with a second exemplary embodiment of the invention.

20

Exemplary Embodiments of the Invention

The invention is explained using the example of an electrical insulation device for an IEEE 1394 bus interface. Figure 1 shows the basic structure of an IEEE 1394 bus interface. The latter comprises the two modules data link layer module 10 and physical layer module 20. These two modules may be integrated on separate chips. It is desirable, however, for these modules to be integrated together on a single chip. The connection between the modules is effected by two bidirectional control lines CTL[0:1], and e.g. eight bidirectional data lines D[0:7], and also a unidirectional control line LREQ proceeding from the data link layer module, and also a control line SCLK for the system clock, proceeding from the physical layer module. For the sake of clarity, it is also mentioned that the connection to a further IEEE 1394 bus interface is effected via external connecting lines which

are not illustrated and are connected to the physical layer module 20. Accordingly, the data link layer module 10 contains connections which connect the IEEE 1394 bus interface to an application unit. For further details 5 regarding the structure and the method of operation of the modules data link layer module and physical layer module, reference is made to the IEEE 1394 standard already mentioned above.

In accordance with a proposal in the IEEE 1394 10 standard, the electrical insulation device 30 is provided between the data link layer module 10 and the physical layer module 20. This is illustrated in Figure 2.

The structure of the electrical insulation device 30 is represented for a first exemplary embodiment in 15 Figure 3, in which an optocoupler unit is designated by the reference numeral 31. This unit contains two separate optocouplers 311, 312. The latter are reverse-connected in parallel, so that the light-emitting element of one optocoupler is connected to that part of the 20 bidirectional connecting line which is connected to the data link layer module 10, and the light-emitting element of the other optocoupler is fed by that part of the connecting line which is connected to the physical layer module. In the example shown, the control line CTL[0] is 25 connected to the optocoupler unit 31. Between the two optocouplers, a respective tristate driver 32 is connected on each side of the optocoupler unit 31. The two tristate drivers 32 illustrated are switched by complementary enable signals \overline{EN} and EN. This will be 30 discussed in more detail below. The tristate drivers 32 have the following effect. They can be switched either into a high-impedance state or into a low-impedance state in which they allow signals to pass. If we suppose that the tristate driver 32 on the side of the data link layer 35 module 10 is switched in a low-impedance manner, a signal flow is possible via the control line CTL[0] proceeding from the physical layer module 20 via the lower optocoupler 312 to the data link layer module 10. The

reverse signal flow is simultaneously inhibited, since the tristate driver 32 on the side of the physical layer module 20 is simultaneously switched in a high-impedance manner. In parallel with this, it is also possible, of course, to effect a switch-off of the upper optocoupler at the same time. In the reverse case, that is to say if the left-hand tristate driver 32 is switched in a high-impedance manner and the right-hand tristate driver 32 is switched in a low-impedance manner, a signal flow is possible from the data link layer module 10 to the physical layer module 20 via the control line CTL[0]. The changeover of the tristate drivers 32 is effected with the aid of the control signals EN and \overline{EN} by the control unit 33. To that end, the control unit 33 evaluates the signal states on the two control lines CTL[0:1]. For complete functioning, the clock signal SCLK or a clock signal modified therefrom and also a reset signal are additionally fed to the control unit 33.

The IEEE 1394 standard provides for the physical layer module 20 to have control over the bidirectional connecting lines CTL[0:1] and D[0:7]. The data link layer module 10 is permitted to drive these bidirectional connecting lines only when the physical layer module 20 relinquishes its control over these lines to the data link layer module 10. A full explanation of when and how the physical layer module 20 relinquishes its control over the bidirectional connecting lines can be found in Appendix J of the IEEE 1394 standard. A state diagram for the control unit 33, which fulfills the specifications of the IEEE 1394 standard, is shown in Figure 4 and is explained in more detail below.

Before that explanation, it is also pointed out that the structure shown in Figure 3 with the tristate drivers 32 and the optocoupler arrangement 31 must be present for each of the bidirectional connecting lines between data link layer module 10 and physical layer module 20, that is to say for the control lines CTL[0:1] and the data lines D[0:7]. For the two unidirectional

control lines LREQ and SCLK, simple optocouplers must be present in a complete electrical insulation device, which optocouplers, however, only have to act in one direction in accordance with the unidirectionality of these lines.

5 That state diagram of the control unit 33 shows 4 states. After a reset or after the initialization of the bus interface, the control unit 33 is put into the state IDLE. In this state, the control unit outputs the logic states $EN=0$ and $\overline{EN}=1$ as output signals. This is
10 equivalent to the changeover of the left-hand tristate driver 32 of Figure 3 into the low-impedance state and the changeover of the right-hand tristate driver 32 into the high-impedance state. The signal flow via all the bidirectional lines therefore proceeds from the physical
15 layer module 20 to the data link layer module 10. This state is left if the logic level 1 has been detected in a clock cycle on both control lines CTL[0] and CTL[1]. The control unit 33 is then put into the state CHECK0. It then awaits the state of the two control lines in the
20 next clock cycle. If both control lines have the state logic 0, the control unit 33 is put into the state LINK. In all other cases, the control unit 33 returns to the IDLE state. In the LINK state, the combination $EN=1$ and $\overline{EN}=0$ is output as output signal. This is equivalent to
25 the relinquishing of control over the bidirectional connecting lines to the data link layer module 10. Consequently, the left-hand tristate driver 32 of Figure 3 is then put into the high-impedance state and the right-hand tristate driver 32 is switched to the
30 low-impedance state. Thus, the signal flow for all the bidirectional lines then proceeds from the data link layer module 10 to the physical layer module 20. If, in this state, the logic 0 state arises on both control lines CTL[0:1], then the control unit 33 leaves the LINK
35 state and changes over to the CHECK1 state. In this state, a check is made to determine whether the logic state 0 is likewise supplied via both control lines in the subsequent clock cycle. If this is the case, the

control unit 33 changes back to the IDLE state. Otherwise, it changes over to the LINK state.

The alternative embodiment of an electrical isolation device according to the invention will now be explained in more detail with reference to Figure 5. Similar components are designated by the same reference symbols as in Figure 3. The difference from the solution as shown in Figure 3 consists in the fact that, in the optocoupler unit 31, only one optocoupler is provided per bidirectional connecting line. However, the effective direction of the said optocoupler is changed over in a manner dependent on the signals on the control lines CTL[0:1]. This is effected by 4 tristate drivers 32 per connecting line. In this case, the control unit 33 is constructed in exactly the same way as in the example of Figure 3. It functions according to the same state diagram as illustrated in Figure 4. Thus, in the IDLE state, it will output the logic states 0 and 1 via the lines EN and \overline{EN} . As a result, the first of the two tristate drivers 32 on the left-hand side of Figure 5 is switched in a high-impedance manner and the second tristate driver is accordingly switched in a low-impedance manner. Accordingly, the first of the two tristate drivers on the right-hand side of Figure 5 is likewise switched in a high-impedance manner and the other in a low-impedance manner. The signal flow is then as follows. The signal flows via the data line D[0] proceeding from the physical layer module 20 as transmitter to the second tristate driver 32 on the left-hand side of Figure 5 via the optocoupler to the second tristate driver 32 on the right-hand side of Figure 5 and from there to the data link layer module. In the other state LINK, the logic signals 1 and 0 are output on the lines EN and \overline{EN} . This changes over the signal flow. As a result, the data link layer module 10 operates as transmitter. The data pass through the first tristate driver 32 on the left-hand side of Figure 5, the optocoupler in the optocoupler unit 31, the first

tristate driver 32 on the right-hand side of Figure 5 and pass from there to the input of the physical layer module 20.

The above-described embodiments of an electrical insulation device can be advantageously used not just for the IEEE 1394 bus standard. They can be employed wherever bidirectional connecting lines are intended to be provided with electrical insulation. This problem can also arise in other bus systems.

Claims

1. Electrical insulation device with optocoupler for bidirectional connecting lines, one connecting line 5 connecting two circuit units (10, 20) to one another, **characterized in that** two separate optocouplers (311, 312) are provided per bidirectional connecting line CTL[0:1], D[0:7], and in that a control unit (33) is provided, which generates switching signals (EN, \overline{EN}) in 10 a manner dependent on control signals output by one of the two circuit units (10, 20), which switching signals activate one of the two optocouplers (311, 312) and deactivate the other optocoupler, for transmission of signals via the associated connecting line (CTL[0:1], 15 D[0:7]) in one direction.

2. Electrical insulation device with optocoupler, one connecting line (CTL[0:1], D[0:7]) connecting two circuit units (10, 20) to one another **characterized in** 20 **that** one optocoupler is provided per bidirectional connecting line (CTL[0:1], D[0:7]), which optocoupler is utilized for both directions of signal transmission via the associated connecting line, a control unit (33) being provided, which generates switching signals (EN, \overline{EN}) in 25 a manner dependent on control signals output by one of the two circuit units (10, 20), and which changes over the effective direction of the optocoupler with regard to the associated connecting line (CTL[0:1], D[0:7]), for transmission of signals via the associated connecting 30 line in one direction.

3. Electrical insulation device according to Claim 1 or 2, the bidirectional connecting lines (CTL[0:1], D[0:7]) relating either to data lines (D[0:7]) or control 35 lines (CTL[0:1]).

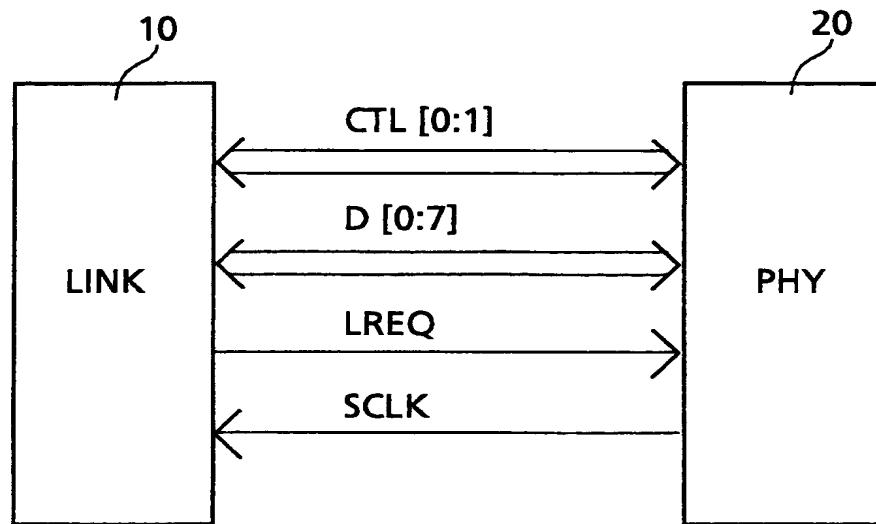
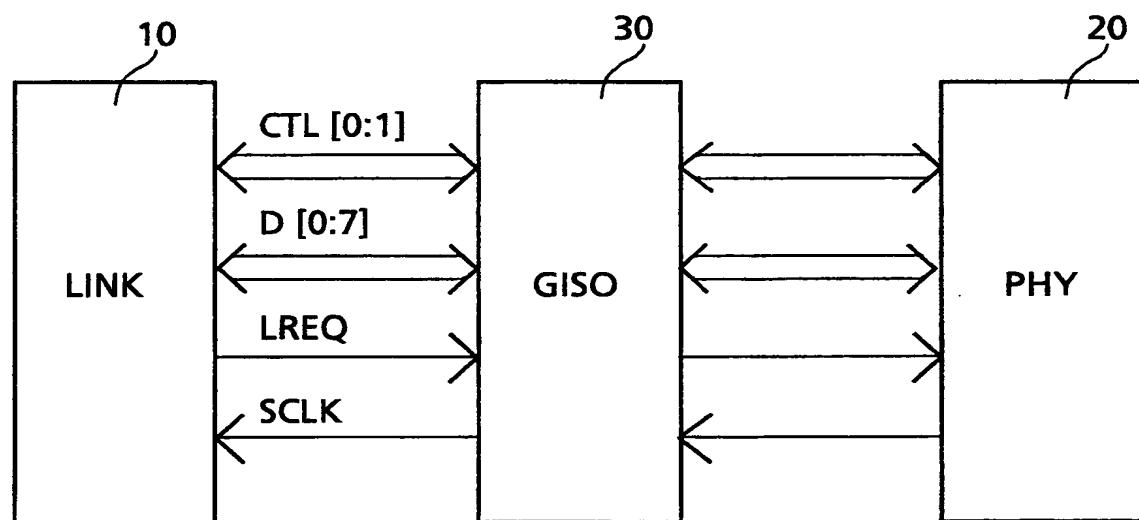
4. Electrical insulation device according to one of Claims 1 to 3, the circuit units (10, 20) which are

connected to one another via the connecting lines relating to the circuit blocks data link layer block (10) and physical layer block (20) of a connection interface, in particular IEEE 1394 bus interface.

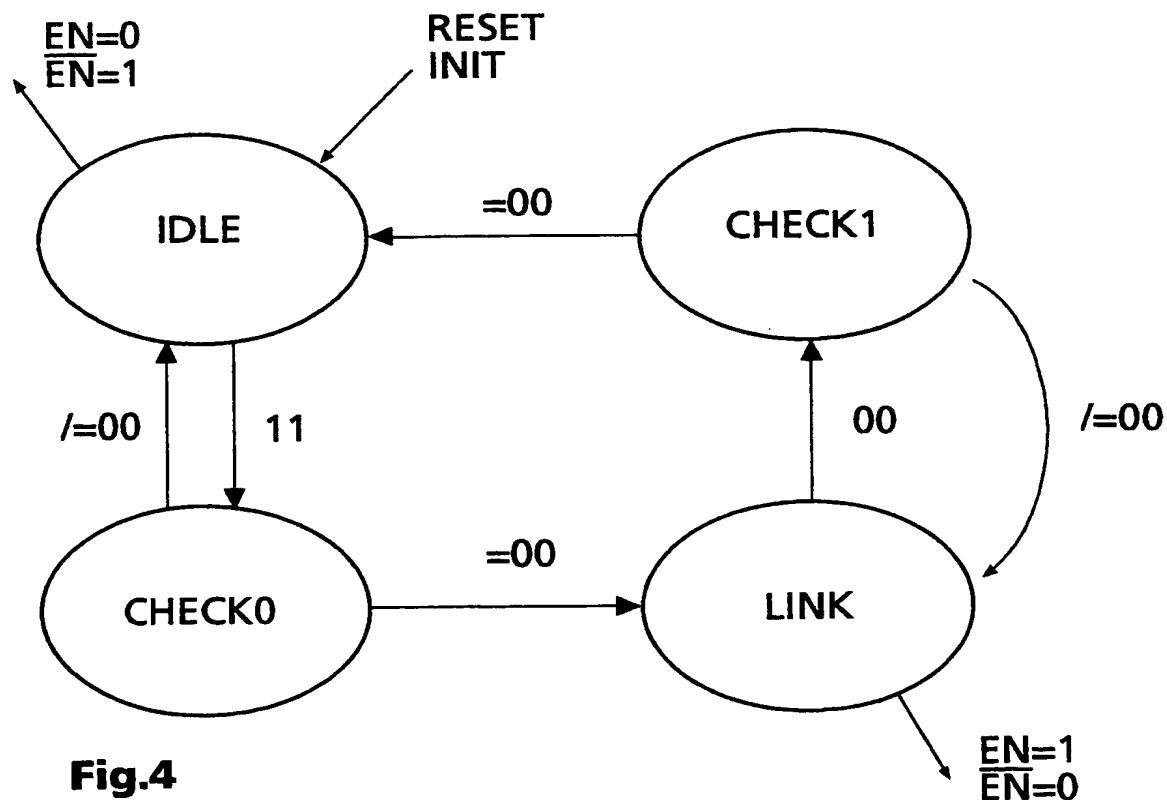
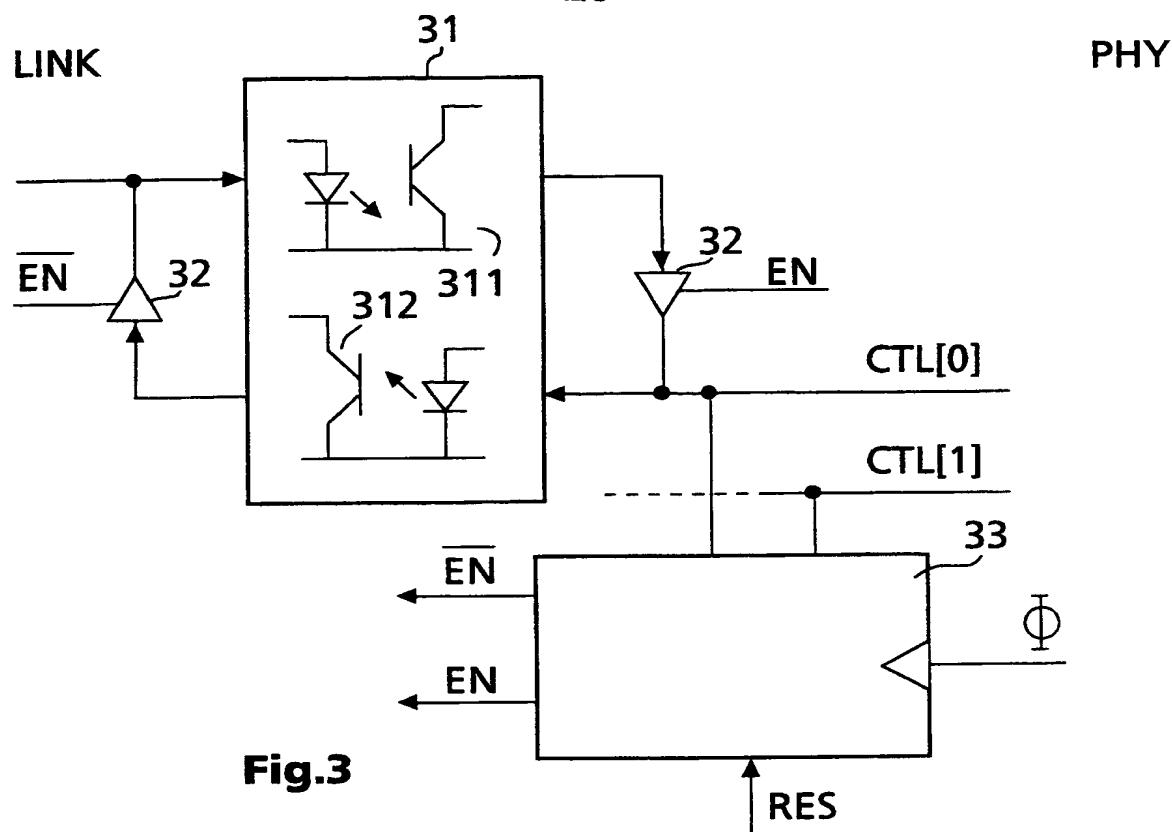
5

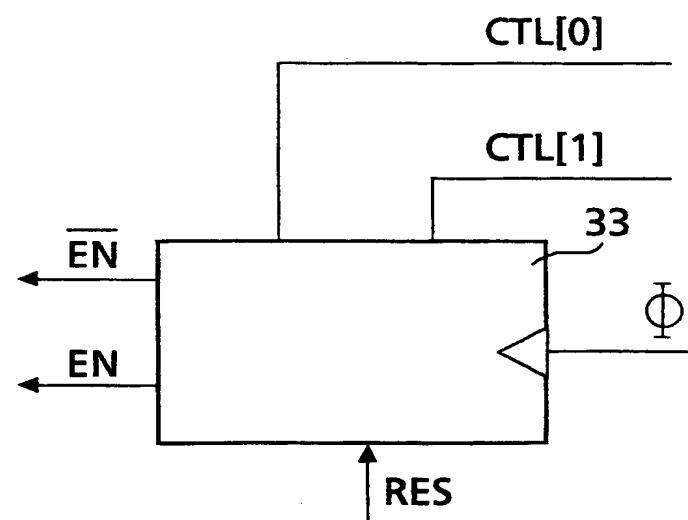
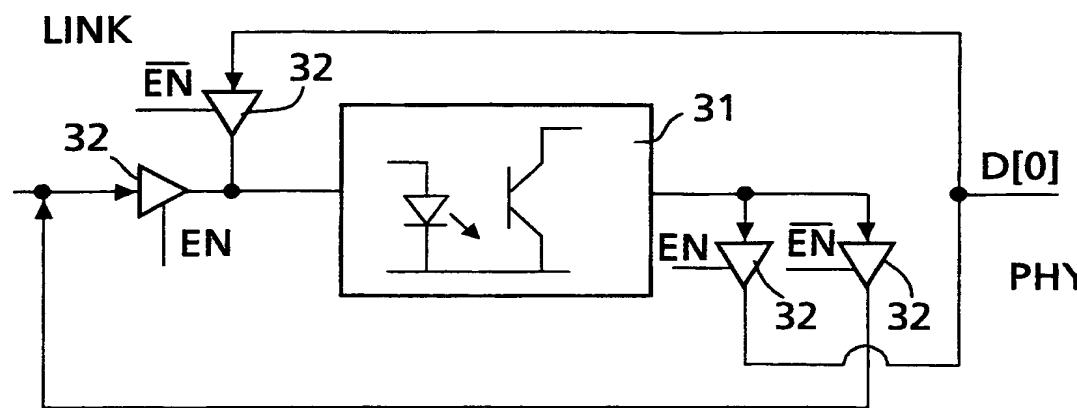
5. Electrical insulation device according to Claim 4, the respective control unit (33) evaluating the control signals on the two control lines (CTL[0:1]) of the connecting bus between data link layer block (10) and 10 physical layer block (20) in accordance with the IEEE 1394 Standard.

6. Electrical insulation device according to one of Claims 1 to 5, tristate drivers (32), which are switched 15 into corresponding states by the control unit (33), being used for changing over between the optocouplers or for changing over the effective direction of one optocoupler.

**Fig.1****Fig.2**

2/3



**Fig.5**

INTERNATIONAL SEARCH REPORT

Application No
PCT/EP 00/06476

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H04B10/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04B H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, INSPEC, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|----------|---|-----------------------|
| A | US 5 663 819 A (LEWIS STEPHEN P) 2 September 1997 (1997-09-02) the whole document --- | 1-6 |
| A | DE 33 29 570 A (TELEFONBAU & NORMALZEIT GMBH) 7 March 1985 (1985-03-07) the whole document --- | 1-6 |
| A | EP 0 905 924 A (NIPPON ELECTRIC CO) 31 March 1999 (1999-03-31) the whole document --- | 1-6 |
| A | DE 44 44 307 A (SIEMENS AG) 20 June 1996 (1996-06-20) the whole document --- | 1-6 |
| | | -/- |

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

* Special categories of cited documents :

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

& document member of the same patent family

Date of the actual completion of the international search

Date of mailing of the international search report

25 October 2000

06/11/2000

Name and mailing address of the ISA

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Authorized officer

Phillips, S

INTERNATIONAL SEARCH REPORT

Application No
PCT/EP 00/06476

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|----------|---|-----------------------|
| A | <p>WRIGHT M: "PRETENDERS, CONTENDERS, OR LOCKS FOR UBIQUITOUS DESKTOP DEPLOYMENT?" EDN ELECTRICAL DESIGN NEWS, US, CAHNERS PUBLISHING CO. NEWTON, MASSACHUSETTS, vol. 41, no. 9, 25 April 1996 (1996-04-25), pages 79-80, 82, 84, 86, XP000592137 ISSN: 0012-7515 the whole document</p> <p>-----</p> | 1-6 |

INTERNATIONAL SEARCH REPORT

Information on patent family members

Intern'l Application No

PCT/EP 00/06476

| Patent document cited in search report | Publication date | Patent family member(s) | | Publication date |
|--|------------------|-------------------------|--------------|-------------------------|
| US 5663819 | A 02-09-1997 | WO 9912289 | A 11-03-1999 | AU 4173597 A 22-03-1999 |
| DE 3329570 | A 07-03-1985 | NONE | | |
| EP 0905924 | A 31-03-1999 | JP 11168436 | A 22-06-1999 | |
| DE 4444307 | A 20-06-1996 | WO 9619051 | A 20-06-1996 | |

QL
PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

| | | |
|--|---|--|
| Applicant's or agent's file reference PD990054 | FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below. | |
| International application No. PCT/EP 00/ 06476 | International filing date (day/month/year) 07/07/2000 | (Earliest) Priority Date (day/month/year) 19/07/1999 |
| Applicant DEUTSCHE THOMSON-BRANDT GMBH | | |

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report.

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.
 - the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).
- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing:
 - contained in the international application in written form.
 - filed together with the international application in computer readable form.
 - furnished subsequently to this Authority in written form.
 - furnished subsequently to this Authority in computer readable form.
 - the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
 - the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. **Certain claims were found unsearchable** (See Box I).

3. **Unity of Invention is lacking** (see Box II).

4. With regard to the **title**,

the text is approved as submitted by the applicant.
 the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

the text is approved as submitted by the applicant.
 the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

as suggested by the applicant.
 because the applicant failed to suggest a figure.
 because this figure better characterizes the invention.

3

None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 00/06476

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04B10/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04B H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, INSPEC, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category ° | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|------------|--|-----------------------|
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| A | DE 33 29 570 A (TELEFONBAU & NORMALZEIT GMBH) 7 March 1985 (1985-03-07) the whole document ---- | 1-6 |
| A | EP 0 905 924 A (NIPPON ELECTRIC CO) 31 March 1999 (1999-03-31) the whole document ---- | 1-6 |
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| | | -/- |

 Further documents are listed in the continuation of box C. Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
"&" document member of the same patent family

| | |
|--|--|
| Date of the actual completion of the international search | Date of mailing of the international search report |
| 25 October 2000 | 06/11/2000 |
| Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016 | Authorized officer Phillips, S |

INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 00/06476

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|----------|--|-----------------------|
| A | WRIGHT M: "PRETENDERS, CONTENDERS, OR LOCKS FOR UBIQUITOUS DESKTOP DEPLOYMENT?" EDN ELECTRICAL DESIGN NEWS, US, CAHNERS PUBLISHING CO. NEWTON, MASSACHUSETTS, vol. 41, no. 9, 25 April 1996 (1996-04-25), pages 79-80, 82, 84, 86, XP000592137 ISSN: 0012-7515 the whole document ----- | 1-6 |

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/EP 00/06476

| Patent document cited in search report | Publication date | Patent family member(s) | | Publication date |
|--|------------------|-------------------------|--------------|-----------------------|
| US 5663819 | A 02-09-1997 | WO 9912289 | A 11-03-1999 | AU 4173597 22-03-1999 |
| DE 3329570 | A 07-03-1985 | NONE | | |
| EP 0905924 | A 31-03-1999 | JP 11168436 | A 22-06-1999 | |
| DE 4444307 | A 20-06-1996 | WO 9619051 | A 20-06-1996 | |

14
PATENT COOPERATION TREATY

REC'D 09 OCT 2001

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

| | | | |
|---|--|--|---|
| Applicant's or agent's file reference PD990054 | FOR FURTHER ACTION | | See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416) |
| International application No. PCT/EP00/06476 | International filing date (day/month/year) 07/07/2000 | Priority date (day/month/year) 19/07/1999 | |
| International Patent Classification (IPC) or national classification and IPC H04B10/00 | | | |
| Applicant THOMSON LICENSING S.A. DEUTSCHE THOMSON-BRANDT GMBH | | | |

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 5 sheets, including this cover sheet.

This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 2 sheets.

3. This report contains indications relating to the following items:

- I Basis of the report
- II Priority
- III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV Lack of unity of invention
- V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI Certain documents cited
- VII Certain defects in the international application
- VIII Certain observations on the international application

| | |
|---|---|
| Date of submission of the demand 20/01/2001 | Date of completion of this report 08.10.2001 |
| Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465 | Authorized officer Phillips, S Telephone No. +49 89 2399 8674 |



INTERNATIONAL PRELIMINARY
EXAMINATION REPORT

International application No. PCT/EP00/06476

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):
Description, pages:

1-10 as originally filed

Claims, No.:

1-5 with telefax of 11/07/2001

Drawings, sheets:

1/3-3/3 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- the language of publication of the international application (under Rule 48.3(b)).
- the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- contained in the international application in written form.
- filed together with the international application in computer readable form.
- furnished subsequently to this Authority in written form.
- furnished subsequently to this Authority in computer readable form.
- The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- the description, pages:
- the claims, Nos.:

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/EP00/06476

the drawings, sheets:

5. This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)
see separate sheet

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N) Yes: Claims 1-5
 No: Claims

Inventive step (IS) Yes: Claims 1-5
 No: Claims

Industrial applicability (IA) Yes: Claims 1-5
 No: Claims

2. Citations and explanations
see separate sheet

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/EP00/06476

Section I

1. **Claim 1** is based on original claims 1 and 2 plus the description page 6 lines 9-12.
2. The wording "in a manner dependent on control signals output by one of the two circuit units" which was present in claims 1 and 2 has not been included in the present **claim 1**. This is considered as a broadening of the subject matter over that contained in the application as originally filed since the switching signals are now no longer limited to being generated in dependence on control signals output by one of the two circuit units (Rule 70.2(c) PCT).

Section V

1. The application relates to an electrical insulation device for a bidirectional connecting line (**claim 1**).
2. The prior art relevant to the subject matter of **claim 1** is outlined in the description from page 1 line 9 to page 3 line 5. Neither this prior art, nor the documents cited in the International search report, disclose the use of optocouplers controlled by switching signals provided by a control unit dependent on control signals output by one of two circuit units, for switching the direction of signals along a bidirectional line connecting the two circuit units. The subject-matter of **claim 1** is therefore novel (Article 33(2) PCT).
3. Problem: How to control bidirectional signal flow between a data link layer module and a physical layer module (circuit units) of a bus interface which are integrated on a single chip.
4. Solution: The feature which is new with respect to the available prior art is to provide either a single optocoupler or two separate optocouplers controlled by switching signals provided by a control unit dependent on control signals output by one of two circuit units, for switching the direction of signals along a bidirectional line connecting the two circuit units. None of the available prior art documents provide any hint to do this and hence the particular solution is non-obvious and considered to be inventive (Article 33(3) PCT).

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/EP00/06476

5. The dependent claims add further features to the independent claims and thus also relate to novel and inventive subject matter and hence meet the requirements of Article 33(2) and (3) PCT.

EXPRESS EL722193412US

INTERNATIONAL SEARCH REPORT

Internat'l Application No
PCT/EP 00/06476A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04B10/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04B H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, INSPEC, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|------------|--|-----------------------|
| A | US 5 663 819 A (LEWIS STEPHEN P) 2 September 1997 (1997-09-02) the whole document | 1-6 |
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| A | EP 0 905 924 A (NIPPON ELECTRIC CO) 31 March 1999 (1999-03-31) the whole document | 1-6 |
| A | DE 44 44 307 A (SIEMENS AG) 20 June 1996 (1996-06-20) the whole document | 1-6 |
| | --- | |
| | -/- | |

 Further documents are listed in the continuation of box C. Patent family members are listed in annex.

* Special categories of cited documents :

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *&* document member of the same patent family

| | |
|---|--|
| Date of the actual completion of the international search 25 October 2000 | Date of mailing of the international search report 06/11/2000 |
| Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentstaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl. Fax: (+31-70) 340-3016 | Authorized officer Phillips, S |

INTERNATIONAL SEARCH REPORT

Internat'l Application No
PCT/EP 00/06476

| C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT | | |
|--|--|-----------------------|
| Category | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
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International Application No

PCT/EP 00/06476

| Patent document cited in search report | Publication date | Patent family member(s) | | Publication date |
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| | | AU 4173597 A | | 22-03-1999 |
| DE 3329570 | A 07-03-1985 | NONE | | |
| EP 0905924 | A 31-03-1999 | JP 11168436 A | | 22-06-1999 |
| DE 4444307 | A 20-06-1996 | WO 9619051 A | | 20-06-1996 |